

CURRICULUM OUTLINE AND SYLLABUS OF THE *DOCTOR OF MEDICINE (DM) COURSE IN NEONATOLOGY*

1. AIM

The aim of the DM Programme is to provide advanced training in Neonatology to produce competent super-specialists who are able to provide clinical care of the highest order to the newborn infants, and serve as future teachers, trainers, researchers and leaders in the field of Neonatology.

2. LEARNING OBJECTIVES

After completing the DM (Neonatology) course, the student will be able to :

1. Analyse neonatal health problems scientifically, taking into account the biological basis as well as the socio-behavioural epidemiology of perinatal-neonatal disease, and advise and implement strategies aimed at prevention of neonatal morbidity and mortality.
2. Provide primary, secondary and tertiary care to all newborn infants including intensive care of the highest standard to the critically sick and the very low birth weight neonates using advanced therapeutic and supportive modalities and skills.
3. Implement a comprehensive follow up and early intervention programme for the 'at risk' newborn infants, and plan, counsel and advise rehabilitation of the neurodevelopmentally challenged infants.
4. Take rational decisions in the face of ethical dilemmas in neonatal-perinatal practice.
5. Exhibit communication skills of a high order and demonstrate compassionate attributes befitting a caring neonatologist.
6. Plan and carry out research in neonatal health in clinical, community and laboratory settings.
7. Teach newborn care to the medical and the nursing students as well as grassroots health functionaries, and develop learning resource materials for them.
8. Plan, establish and manage level II and level III neonatal units independently.
9. Use and maintain the essential neonatal equipment and keep abreast with advances in newborn care technology.

10. Organize newborn care in the community and at the secondary level of health system, and play the assigned role in the national programmes aimed at the health of mothers and their infants.
11. Work as a productive member of the interdisciplinary team consisting of obstetricians, pediatricians, pediatric surgeons, other doctors, nurses, and grassroots functionaries providing care to the pregnant mother, the fetus and the newborn in any setting of health care system.
12. Seek and analyse new literature and information on neonatology, update the concepts, and practise evidence-based neonatology.

3. DURATION

3 years

4. ELIGIBILITY

M.D. Pediatrics or equivalent (including Diplomate of National Board in Pediatrics)

5. SELECTION

5.1 The selection of candidates for the DM neonatology course will be based not only on their knowledge, but also clinical skills and aptitude. The knowledge will be assessed through a Theory Test consisting of multiple choice questions covering neonatology and rest of pediatrics of the level of MD (Pediatrics). The clinical skills and the aptitude will be tested by a Practical Test consisting of clinical cases and a grand viva voce. The weightage of the theory and practical tests will be equal.

5.2 The *distribution* of marks for the selection test will be as follows :-

- **Theory Test** **50%**
 - Neonatology 25%
 - Rest of Pediatrics 25%
- **Practical Test** **50%**
 - Clinical assessment (neonatal cases) 25%
 - Grand viva voce 25%

5.3 The theory test will be the screening test. Based on the Theory Test, the topmost candidates equaling three times the number of available seats will be called for the Practical Test.

6. POSTINGS

6.1 Overview

The total period of DM course is 36 months. Of this, at least three fourths (27 months) will be spent in the newborn service, 6 months will be meant for essential rotations in related specialties and the rest 3 months will be apportioned for either optional rotations or for the newborn service.

6.2 Newborn services

The candidates will have at least 27 months of posting in the newborn services at concerned institutions. The candidates must get adequate exposure to neonatal follow up, neonatal emergencies, delivery room care of neonates and acquisition of practical skills (specified in Annexure I).

6.3 Essential Rotations

- Perinatology – obstetrics (Deptt. of Obstetrics-Gynecology) : 2 months
- Neonatal surgery (Deptt of Pediatric Surgery) : 1 months
- Community neonatology : 1 month
- Elective* : 2 months

*The candidates can undertake upto 2 months' elective rotation at the parent or other institutions in the country or abroad at centres approved by the Department.

6.4 Optional rotations

- The departments will have the flexibility of additional rotations for upto 3 months in the above mentioned disciplines or in other relevant areas such as (neonatal cardiology/cardiac surgery, rehabilitation service, genetics perinatal pathology, imaging, anaesthesiology, neonatal ophthalmology, epidemiology/bostatistics, informatics and education technology etc.) depending upon the strength of the disciplines and functional requirements at the concerned institutions. [Under no circumstances however, would the training in neonatal services be of less than 27 months i.e three fourths of the total course.]

7. LEARNING OPPORTUNITIES

- Learning in DM neonatology will essentially be self-directed and will take place while working in various areas and through interactions in the rounds.
- Following minimum formal sessions are recommended in order to facilitate and supplement the efforts of the faculty and students :

- Journal club (once in 2 weeks)
 - Perinatal round (once in 2 weeks)
 - Physiology round (once in 2 weeks)
 - Seminar (once in 2 weeks)
 - Clinical case discussion (once a week)
- In addition, depending on the strength of the institutions sessions or imaging, pathology, microbiology, as well as interdepartmental seminars may be undertaken.

8. RESEARCH

- 8.1 The candidates will be required to submit one thesis during the course of DM programme. Progress on dissertations will be reviewed every semester and feed back given to the candidates. The candidate will make at least 3 formal presentations to the Department, namely, (i) Protocol , (ii) Mid- course progress and (iii) Final report. Thesis will be submitted at least six months before the completion of the course.
- 8.2 Two papers (pertaining to the thesis or otherwise) for publication in indexed journal(s) before appearing for the final DM examination.
- 8.3 The candidate must attend continuing education symposia, workshops and conferences including meetings of the National Neonatology Forum, workshops neonatal resuscitation and ventilation etc.

9. TEACHING EXPERIENCE

- The candidates will be regularly involved in the teaching of undergraduate medical/nursing students and pediatrics postgraduate students. Their teaching skills will be assessed and shall form part of the internal assessment.

10. ASSESSMENT

10.1 Overview of DM Assessment

- A maximum of 800 marks will be awarded. The candidate must obtain at least 50% (i.e. 400) marks to pass the examination (Table 1).
- Of the 800 marks, 200 marks (25%) will be for the Internal Assessment. The breakup of Internal Assessment marks is shown in Table 2.
- A total of 600 marks, will be assigned to the Final Examination (Theory 300, Practicals 300). It will be essential to pass theory and practical both separately in the Final Examination by securing at least 50% marks in each.

Table 1 Overview of DM Assessment

• Internal assessment	200 marks
Continuous	50
Mid-term examination	125
Teaching, research etc.	25
• Final examination	600 marks
Theory	300
Practical	300

TOTAL	800 marks
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10.1 Internal assessment [200 marks]

- *The outline of internal assessment is shown hereunder.*

i.	<i>Continuous assessment</i>	50 marks
	Consultants' reports , <u>every 6 months</u> ; (5 such reports, each of 10 marks)	
ii.	<i>Mid-term examinations</i>	125 marks
	<u>(three</u> such <i>viz.</i> , at completion of 6 months, 18 months and 30 months of training, respectively)	
(iii)	<i>Evaluation of research, teaching and</i>	25 marks

managerial abilities (assessed at two stages viz. at completion of 18 months and 30 months)

- Details of time schedule and break-up is shown in Table 2.

Table 2 : Schedule and break-up of internal assessment and respective marks (in parentheses)

Heading	At completion of how many <i>months</i> of training						Total marks
	6	12	18	24	30	36	
Continuous [50]							(50)
Mid term examinations [125]	+		+		+		
Practical	(10)		(20)		(20)		(50)
Theory	(15)		(30)		(30)		(75)
Research, teaching & managerial skills			(10)		(15)		(25)
TOTAL INTERNAL ASSESSMENT MARKS							(200)

NB :

- Continuous assessment will be done on an ongoing basis using a **log book** covering day to day performance of the candidate. It will be compiled and converted into marks by the faculty every 6 months.
- The scope of curriculum covered in the three mid-term examinations will be decided by the departments beforehand.
- Tools and methods will be developed by the departments to assess research, teaching and managerial skills.

10.2 Final Examination

10.2.1 Final assessment will be carried out by two EXTERNAL EXAMINERS and two INTERNAL EXAMINERS. The summary of the examination is shown in Table 3.

Table 3 : Summary of final DM Examination

1. Theory		300
Paper I	100	
Paper II	100	
Paper III	100	
2. Practical		300
Long case I	60	
Long case	60	
Short case I	40	
Short case II	40	
OSCE/Spots	40	
Viva Voce	60	
NB : Candidate must pass in theory and practical independently by obtaining at least 150 marks in theory as well as in practicals		

10.2.2 Final Theory Examination

(300 marks)

- This will have three papers of 100 marks each. The broad areas covered in the these papers will be as follows:

Paper I	Basic sciences as applied to neonatology and perionatology; research methods (100 marks)
Paper II	Clinical neonatology (100 marks)
Paper III	Community neonatology; national MCH programmes; allied disciplines such as; neonatal surgery; neurodevelopment follow up, rehabilitation etc. (100 marks)

- Theory examination will consist of structured essay questions with emphasis on problem-solving exercises.

10.2.3 Final Practical Examination

(300 marks)

- Long case I (a neonate receiving intensive care) (60 marks)
- Long case II (60 marks)
- Short case I (40 marks)
- Short case II (a follow up high risk newborn) (40 marks)
- Objective Structured Clinical Examination (OSCE) (40 marks)
or if not possible, spots examination
- Structured Viva Voce (two parts) (60 marks)
- Patient management problems (20 marks)
- General viva (including radio- imaging investigations i.e. ultrasound/CT/MRI records, interpretation of ABGs' neurophysiological records such as BERA, EEG; national programmes, policy (40 marks)

ANNEXURE I
DM (Neonatology) Programme

LIST OF SKILLS

CLINICAL

- Neonatal examination, anthropometry and developmental assessment
- Neonatal resuscitation
- Neonatal ventilation : CPAP, IMV; newer modes of ventilation
- Blood sampling : Capillary, venous, arterial
- Insertion of peripheral venous, umbilical venous and umbilical arterial catheters
- Monitoring : invasive, non-invasive
- Enteral feeding (katori-spoon, gavage, breast)
- Lactation management
- Parenteral nutrition
- Lumbar puncture and ventricular tap
- Placing of 'chest tube'
- Exchange transfusion
- Bed side tests : shake test, sepsis screen, hematocrit, urine examination, CSF examination, Kleihauer technique, Apt test etc.
- Neonatal drug therapy
- Nursery house keeping routines and asepsis procedures
- Universal precautions
- Handling, effective utilization and trouble shooting of neonatal equipment.

COMMUNICATION

- Communication with parents, families and communities

EDUCATION/TRAINING

- Teaching skills : lectures, tutorials
- Participatory and small group learning skill
- Principles of educational objectives, assessment and media
- Preparing learning resource material

SELF-DIRECTED LEARNING

- Learning needs assessment, literature search, evaluating evidence

RESEARCH METHOD

- Framing of research question, designing and conducting study, analyzing and interpreting data and writing a paper.

ANNEXURE II
Contents For DM Neonatology Course

A) BASIC SCIENCES

- Basic genetics
- Fetal and neonatal immunology
- Mechanism of disease
- Applied anatomy and embryology
- Feto-placental physiology
- Neonatal adaptation
- Development and maturation of lungs, respiratory control, lung functions, ventilation, gas exchange, ventilation perfusion.
- Physiology and development of cardiovascular system, developmental defects, physiology and hemodynamics of congenital heart disease.
- Fetal and intrauterine growth.
- Development and maturation of nervous system, cerebral blood flow, blood brain barrier.
- Fetal and neonatal endocrine physiology
- Developmental pharmacology
- Developmental hematology, bilirubin metabolism
- Renal physiology
- Physiology of gastrointestinal tract, digestion, absorption.
- Electrolyte balance
- Metabolic pathways pertaining to glucose, calcium and magnesium
- Biochemical basis of inborn errors of metabolism

B) GENERAL TOPICS

- Research methodology
- Biostatistics
- Ethics in perinatology/neonatology
- Principles of education (objectives, curriculum, assessment and use of media)
- Computer, informations technology, internet

C) PERINATOLOGY

- Perinatal and neonatal mortality, morbidity, epidemiology.
- High risk pregnancy: detection, monitoring and management.
- Fetal monitoring, clinical, electronic; invasive, and non-invasive
- Intrapartum monitoring and procedures
- Assessment of fetal risk, and decision for termination of pregnancy
- Diagnosis and management of fetal diseases
- Medical diseases affecting pregnancy and fetus, psychological and ethical considerations
- Fetal interventions.
- Fetal origin of adult disease

- D) NEONATAL RESUSCITATION**
- E) NEONATAL VENTILATION**
- F) BLOOD GAS AND ACID BASE DISORDERS**

7. NEONATAL ASSESSMENT AND FOLLOW UP

- Assessment of gestation, neonatal behaviour, neonatal reflexes
- Developmental assessment, detection of neuromotor delay, stimulation techniques
- Immunization

8. BODY SYSTEMS

i) RESPIRATORY SYSTEM

- Neonatal airways: physiology, pathology; management
- Pulmonary diseases: Hyaline membrane disease, transient tachypnea, aspiration pneumonia, pulmonary air leak syndromes, pulmonary hemorrhage, developmental defects
- Oxygen therapy and its monitoring
- Pulmonary infections
- Miscellaneous pulmonary disorders.

ii) Cardiovascular system

- Fetal circulation, transition from fetal to neonatal physiology
- Examination and interpretation of cardiovascular signs and symptoms
- Special tests and procedures (Echocardiography, angiography)
- Diagnosis and management of congenital heart diseases
- Rhythm disturbances
- Hypertension in neonates
- Shock: pathophysiology, monitoring, management.

iii) Gastrointestinal system

- Disorders of liver and biliary system.
- Bilirubin metabolism
- Neonatal jaundice: diagnosis, monitoring, management, phototherapy, exchange transfusion.
- Prolonged hyperbilirubinemia
- Kernicterus
- Congenital malformations
- Necrotising enterocolitis

iv) Nutrition

- Fetal nutrition
 - Physiology of lactation
 - Breast feeding
 - Lactation management, breast milk banking, maternal medications and nursing
 - Parenteral nutrition
 - Vitamins and micronutrients in newborn health
- v) Renal system**
- Developmental disorders
 - Renal functions
 - Fluid and electrolyte management
 - Acute renal failure (diagnosis, monitoring, management).
- vi) Endocrine and metabolism**
- Glucose metabolism, hypoglycemia, hyperglycemia
 - Calcium disorders
 - Magnesium disorders
 - Thyroid disorders
 - Adrenal disorders
 - Ambiguous genitalia
 - Inborn errors of metabolism
- vii) Hematology**
- Physiology
 - Anemia
 - Polycythemia
 - Bleeding and coagulation disorders
 - Rh hemolytic disease
- viii) Neurology**
- Clinical neurological assessment
 - EEG, ultrasonography, CT scan
 - Neonatal seizures
 - Intracranial hemorrhage
 - Brain imaging
 - Hypoxic ischemic encephalopathy
 - Neuro-muscular disorders
 - Degenerative diseases
 - CNS malformation
- ix) Surgery and orthopedics**
- Diagnosis of neonatal surgical conditions
 - Pre and post operative care
 - Neonatal anesthesia
 - Metabolic changes during anesthesia and surgery

- Orthopedic problems
 - x) **Neonatal infections**
 - Intrauterine infections
 - Superficial infections
 - Diarrhea
 - Septicemia
 - Meningitis
 - Osteomyelitis and arthritis
 - Pneumonias
 - Perinatal HIV
 - Miscellaneous infective disorders including HBV and candidemia
 - xi) **Neonatal Imaging**
 - X-rays, ultrasound, MRI, CT Scan etc.
 - xii) **Neonatal ophthalmology**
 - Developmental aspects
 - Retinopathy of prematurity
 - Sequelae of perinatal infections
 - xiii) **Neonatal dermatology**
 - I) **Transport of neonates**
 - J) **Neonatal procedures**
 - K) **Developmental assessment and follow up**
 - xviii) **Organization of neonatal care**
 - xix) **Community neonatology**
 - Vital statistics, health system;
 - Causes of neonatal, perinatal death
 - Neonatal care priorities
 - Care at secondary level of care
 - Care at primary health centre
 - Role of different health functionaries
 - National programmes
 - National Neonatology Forum
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